Myocardial infarction in Hypertensive patients

by

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Abstract

Background

Hypertension is a major risk factor for cardiovascular diseases, including myocardial infarction (MI). Understanding the risk factors associated with MI in hypertensive patients is crucial for developing effective prevention strategies.

Objectives

This study aimed to identify the prevalence and risk factors associated with MI among hypertensive patients at Baquba Teaching Hospital.

Methods

A cross-sectional study was conducted from November 1st to December 1st, 2023. The study included 70 hypertensive patients, systematically sampled from the outpatient department. Data on demographics, clinical history, and lifestyle factors were collected through structured questionnaires and medical records. Chi-square and independent samples T-tests were used for statistical analysis.

Results

The study population had a mean age of 60 years, with 57.1% males. About 47.1% had a history of MI. Significant risk factors for MI in hypertensive patients included improper diet ($P < 0.01$), smoking ($P < 0.01$), uncontrolled hypertension ($P < 0.05$), and a family history of hypertension ($P < 0.01$). Age and duration of hypertension were significantly higher in patients with MI ($P < 0.01$), while no significant difference was found in BMI.

Conclusion

The study identified several modifiable risk factors for MI in hypertensive patients, highlighting the need for targeted interventions focusing on diet, smoking cessation, hypertension control, and family history awareness. These findings contribute to the understanding of MI risk in hypertensive patients, guiding healthcare professionals in risk assessment and management.

Keywords

Hypertension, Myocardial Infarction, Risk Factors, Cross-sectional Study, Baquba Teaching Hospital.

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Introduction

High blood pressure, or hypertension, impacts over a billion people globally, and this figure is on the rise. When left untreated or not properly managed, hypertension becomes the primary cause of various cardiovascular diseases, including stroke, heart failure, myocardial infarction, and kidney disease (1). Cardiovascular risk is higher in sedentary individuals, those with central obesity, and younger overweight people. It's also elevated in socially deprived or certain ethnic groups. Elevated fasting glucose, abnormal glucose tolerance, high triglycerides, fibrinogen, apolipoprotein B, lipoprotein (a), and high-sensitivity C-reactive protein levels also indicate higher risk. Additionally, a family history of early cardiovascular disease (before age 60) increases the risk (2).

Acute myocardial infarction, a severe form of coronary artery disease, is responsible for over 2.4 million deaths annually in the USA and more than 4 million in Europe and northern Asia. It accounts for over a third of all deaths in developed countries each year. Despite significant mortality reductions from coronary heart disease due to evidence-based therapies and lifestyle changes, myocardial infarction continues to significantly impact global health, affecting over 7 million people worldwide annually (3). Patients with acute myocardial infarction (AMI) often have a history of hypertension. This association is commonly seen alongside characteristics such as female sex, diabetes, older age, a lower incidence of smoking, and more frequent vascular comorbidities. This creates a risk profile for AMI in hypertensive patients that is quite distinct from those with normotensive ischemic conditions (4).

This study aims to investigate the relationship between hypertension and myocardial infarction (MI) in patients. The focus of this research is to understand how hypertension contributes to the development and severity of MI, while also exploring its unique interplay with other risk factors such as age, sex, diabetes,

smoking habits, and vascular comorbidities. By examining the distinct characteristics of MI in hypertensive patients, this study seeks to provide deeper insights into the clinical presentation, treatment challenges, and outcomes of MI within this specific patient group. The findings of this research are expected to contribute significantly to the current understanding of cardiovascular diseases and guide more effective management strategies for patients with a history of hypertension.

Aim and Objectives

Aim

This study aims to explore the relationship between Myocardial infarction in hypertensive patients.

Objectives

- To evaluate the relationship between hypertension and the development of myocardial infarction.
- To assess the risk factors associated with myocardial infarction.

Literature review

Hypertension

Arterial hypertension is a leading global risk factor for mortality, accounting for approximately 9.4 million deaths in 2010. Its significant impact on health is well-documented across multiple studies. Hypertension is closely linked to an increased overall cardiovascular risk, contributing to a range of serious cardiovascular and cerebrovascular events. These include myocardial infarction, heart failure, cardiovascular death, and stroke (5). There's also a clear age-dependent positive correlation between systolic blood pressure (SBP)/diastolic blood pressure (DBP) and the occurrence of stroke, as well as between SBP/DBP and ischemic heart disease. This evidence underscores the critical role of hypertension in cardiovascular pathogenesis, making it the foremost risk factor for mortality related to cardiovascular conditions (5).

Diagnosing hypertension necessitates accurate blood pressure (BP) measurement under ideal conditions. This involves the patient being seated and relaxed for at least 5 minutes, with their arm supported. To confirm a diagnosis, it's necessary to record at least two elevated BP readings on two or more separate occasions (6). Regarding BP thresholds for hypertension, there are differing guidelines. The 2017 American College of Cardiology (ACC) considers a BP reading of ≥130/80 mmHg as hypertensive. In contrast, the European Society of Hypertension maintains a threshold of ≥140/90 mmHg (7,8).

Myocardial infarction

Acute myocardial infarction (AMI), commonly known as a heart attack, primarily occurs due to reduced or halted blood flow to a part of the heart, leading to the death (necrosis) of heart muscle tissue. This is typically caused by a blood clot in the coronary artery that supplies blood to the affected area of the heart. However, not all AMI cases are necessarily caused by a blood clot (9).

Over the past three to four decades, there has been a significant change in the epidemiology of acute myocardial infarction (AMI). In the United States, the incidence rate of hospitalizations for AMI or fatal coronary artery disease has decreased annually by 4 to 5% since 1987. Despite this, there are still about 550,000 first episodes and 200,000 recurrent episodes of AMI each year. Globally, ischemic heart disease is now the leading cause of disability-adjusted life years. The burden of cardiovascular disease and AMI has increasingly shifted to low- and middle-income countries, where over 80% of cardiovascular disease deaths occur worldwide (10).

A heart attack, or myocardial infarction, typically presents with chest pain or angina that occurs without prior warning. Common symptoms include chest pain, tightness, squeezing, burning sensations, aching, or heaviness that lasts more than 10 minutes. Other symptoms can include pain in the left shoulder or arm, extending up to the neck or jawline, shortness of breath, excessive sweating, dizziness, muscle weakness, nausea or vomiting, and feelings of anxiety, stress, impending doom, or depression. It's important to note that a "silent heart attack" may occur without any symptoms (11).

Patients suspected of having a heart attack are typically treated urgently in a hospital's Coronary Care Unit. Diagnosis involves reviewing the patient's medical history, conducting a physical examination, and checking blood pressure. An electrocardiogram (ECG or EKG) is performed to detect any abnormalities in the heart's rhythm or blood flow. Blood tests are used to measure levels of proteins and fats that could indicate heart muscle damage. Additionally, coronary angiography, an X-ray of the heart and blood vessels, may be conducted. This procedure involves inserting a catheter into an artery in the leg or arm, threading it to the coronary arteries, injecting a contrast material, and taking X-rays to visualize any heart disease (11).

Risk factors for myocardial infarction (MI) can be categorized into three main groups (12):

Non-modifiable Risk Factors: These include factors that individuals cannot change. They encompass age, gender, and family history. These factors are inherent and play a significant role in the likelihood of developing an MI.

Modifiable Risk Factors: These are factors that individuals can influence through lifestyle choices and medical interventions. They include smoking, alcohol intake, physical inactivity, poor diet, hypertension (high blood pressure), diabetes, dyslipidemias (abnormal cholesterol levels), and metabolic syndrome (a cluster of conditions that increase the risk of heart disease, stroke, and diabetes).

Emerging Risk Factors: These are newer areas of research that are gaining recognition for their potential role in the development of MI. They include C-reactive protein (CRP, a marker of inflammation), fibrinogen (a blood clotting factor), coronary artery calcification (CAC, indicating plaque buildup in arteries), homocysteine (an amino acid linked to heart disease), lipoprotein(a) (a type of lipid in blood), and small, dense low-density lipoprotein (LDL) particles.

Hypertension and Myocardial infarction

Hypertension is linked to an age-related increase in mortality from ischemic heart disease. In developed countries, at least 30% of adults report a history of hypertension, and this condition is independently associated with worse cardiac outcomes following an acute myocardial infarction (MI). Despite this established correlation, the underlying mechanisms remain uncertain (13,14).

Materials and Methods

Study Setting and Duration

This cross-sectional study was conducted at Baquba Teaching Hospital, located in Baquba, Iraq. The data collection phase by convenience sampling spanned from November 1st to December 1st, 2023.

Inclusion Criteria

- Patients diagnosed with hypertension.
- Age 18 years and above.
- Patients willing to provide informed consent.

Exclusion Criteria

- Patients with secondary hypertension due to other primary diseases.
- Pregnant women.
- Patients with terminal illnesses or cognitive impairments that could hinder participation.

Data Collection Tools

A structured questionnaire was used, which included sections on demographic data, clinical history, and lifestyle factors. Medical records were also reviewed for clinical data.

Variables

Dependent Variable

- Myocardial infarction (history of occurrence).

Independent Variables

- Age, sex, body mass index (BMI).
- Duration of hypertension.
- Presence of chronic diseases (diabetes mellitus, chronic kidney disease, heart failure, stroke).
- Smoking status.
- Occupation.
- Control of hypertension.
- Family history of hypertension and heart attack.

Ethical Considerations

Ethical approval was obtained from the Ethics Committee of Baquba Teaching Hospital. Informed consent was taken from all participants, ensuring confidentiality and the right to withdraw at any point without any consequence.

Statistical Analysis

Data Management

Data were entered and managed using SPSS software (version 25.0).

Descriptive Statistics

Descriptive statistics (mean, standard deviation, frequencies, and percentages) were used to describe the demographic and clinical characteristics of the study population.

Inferential Statistics

1. **Chi-Square Test**: Used for categorical variables to compare the prevalence of myocardial infarction among different groups based on their categorical variables like sex, smoking status, chronic diseases, occupation, control of hypertension, and family history.

2. **Independent Samples T-Test**: Applied to compare the mean age, duration of hypertension, and BMI between patients with and without a history of myocardial infarction.

Data Interpretation

The results were interpreted at a 95% confidence interval, and a p-value of less than 0.05 was considered statistically significant.

Results

The study comprised 70 hypertensive patients, with an average age of 60 years (SD ± 12.8) and a mean duration of hypertension of 9.4 years (SD ± 5.4). The population included 42.9% females and 57.1% males. Regarding body mass index (BMI), 64.3% were normal weight, 22.9% were overweight, 8.6% were obese, and 4.3% were underweight. In terms of myocardial infarction (MI) history, 47.1% of the participants had experienced an MI, while 52.9% had not. Chronic diseases were also recorded, with 20.3% having diabetes mellitus, and 7.2% each for chronic kidney disease, heart failure, and stroke. Smoking was prevalent in 37.1% of the participants. The majority were workers (74.3%), and 71.4% had controlled hypertension. A family history of hypertension was noted in 67.1%, and a history of heart attack in the family was reported by 30% of the participants (Table 1).

Table (1): Descriptive statistics of study population (N=70).

Variable	Group	Frequency	Percentage
Age (mean ± SD) in years	60 ± 12.8		
Duration (mean ± SD) in years	9.4 ± 5.4		
Sex	Female	30	42.9%
	Male	40	57.1%
Body mass index	Normal	45	64.3%
	Obese	6	8.6%
	Overweight	16	22.9%
	Underweight	3	4.3%
Myocardial infarction	No	37	52.9%
	Yes	33	47.1%
Chronic disease	Chronic kidney disease	5	7.2%
	Heart failure	5	7.2%
	Stroke	5	7.2%
	Diabetes mellitus	14	20.3%
Smoking	No	44	62.9%
	Yes	26	37.1%
Occupation	Retired	18	25.7%
	Worker	52	74.3%
Controlled hypertension	No	20	28.6%
	Yes	50	71.4%

Family history of hypertension	No	47	67.1%
	Yes	23	32.9%
Family history of heart attack	No	49	70.0%
	Yes	21	30.0%

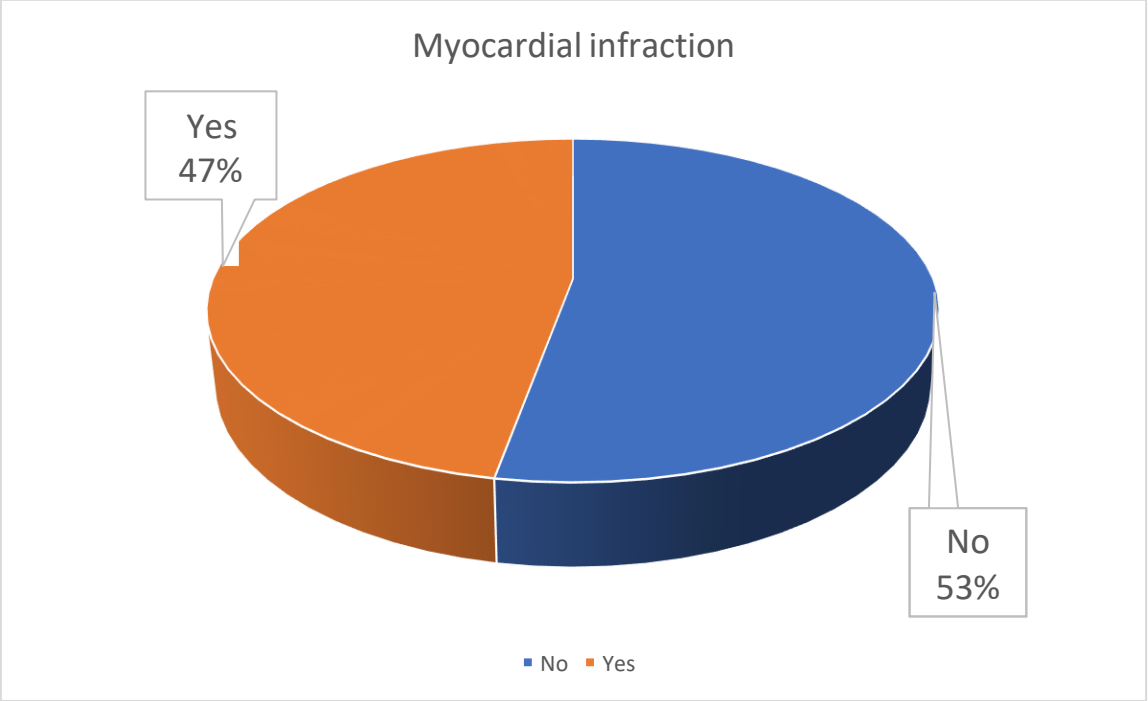

Figure 4.1: Prevalence of Myocardial infraction among hypertensive patients

The analysis of MI risk factors in hypertensive patients revealed no significant association ($P > 0.05$) with sex, chronic kidney disease, heart failure, stroke, or diabetes mellitus. However, significant associations were found with improper diet ($P < 0.01$), smoking ($P < 0.01$), occupation ($P < 0.05$), controlled hypertension ($P < 0.05$), and family history of hypertension ($P < 0.01$). No significant association was observed with BMI and family history of heart attack (Table 2).

Table (2): Myocardial infraction risk factor analysis in hypertensive patients

Variable		Myocardial infraction				P-value
		No		Yes		
		Frequency	Percentage %	Frequency	Percentage %	
Sex	**Female**	15	21.7%	15	21.7%	>0.05 N.S.
	Male	21	30.4%	18	26.1%	
Chronic kidney disease	**No**	32	46.4%	32	46.4%	>0.05 N.S.
	Yes	4	5.8%	1	1.4%	
Heart failure	**No**	34	49.3%	30	43.5%	>0.05 N.S.
	Yes	2	2.9%	3	4.3%	
Stroke	**No**	34	49.3%	30	43.5%	>0.05 N.S.
	Yes	2	2.9%	3	4.3%	
Diabetes mellitus	**No**	31	44.9%	24	34.8%	>0.05 N.S.
	Yes	5	7.2%	9	13.0%	
Improper diet	**No**	29	42.0%	10	14.5%	**<0.01****
	Yes	7	10.1%	23	33.3%	
Smoking	**No**	30	43.5%	13	18.8%	**<0.01****
	Yes	6	8.7%	20	29.0%	
Occupation	**Retired**	5	7.2%	12	17.4%	**<0.05***
	Worker	31	44.9%	21	30.4%	
Controlled hypertension	**No**	6	8.7%	14	20.3%	**<0.05***
	Yes	30	43.5%	19	27.5%	
Family history of hypertension	**No**	29	42.0%	17	24.6%	**<0.01****
	Yes	7	10.1%	16	23.2%	
Family history of heart attack	**No**	27	39.1%	21	30.4%	>0.05 N.S.
	Yes	9	13.0%	12	17.4%	
Body mass index	**Normal**	24	34.8%	20	29.0%	>0.05 N.S.
	Obese	4	5.8%	2	2.9%	
	Overweight	6	8.7%	10	14.5%	
	Underweight	2	2.9%	1	1.4%	

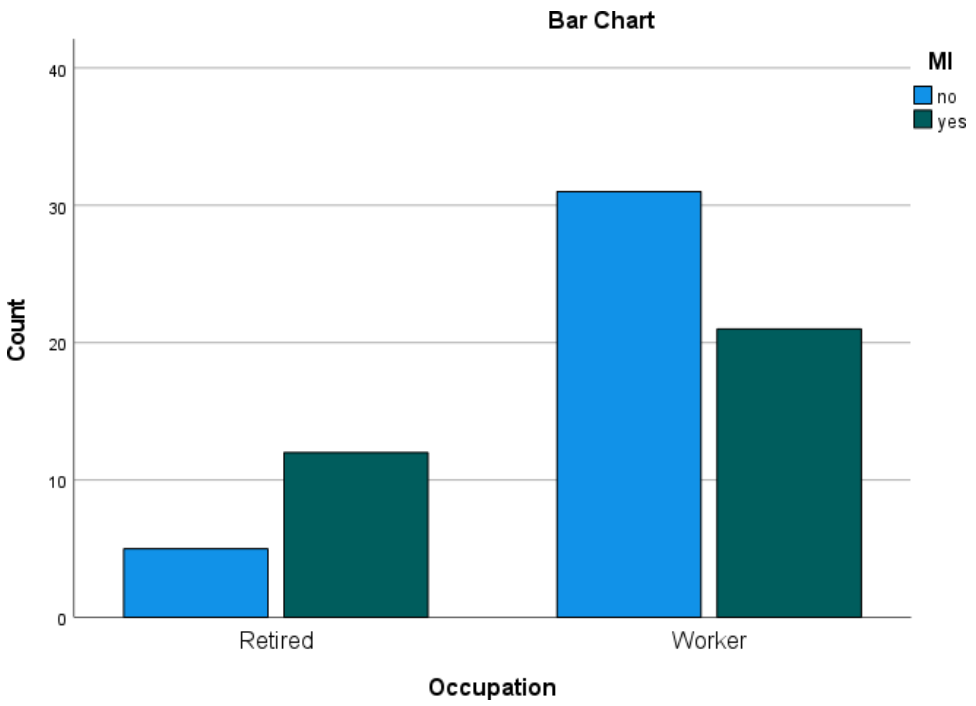

Figure 4.2: Myocardial infraction and Occupation.

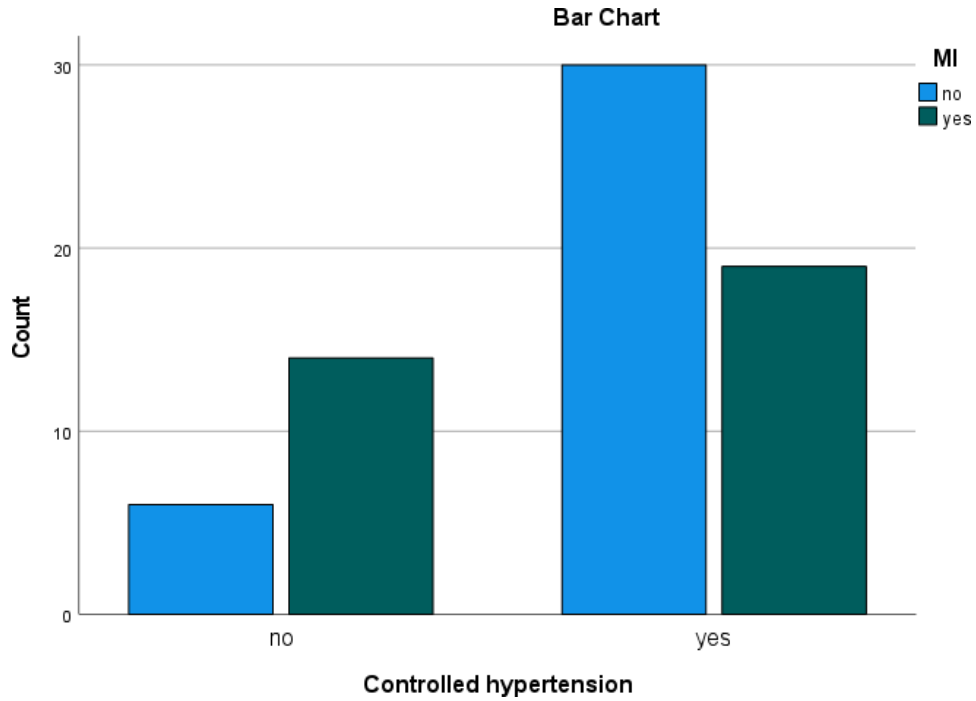

Figure 4.3: Myocardial infraction and Hypertension control.

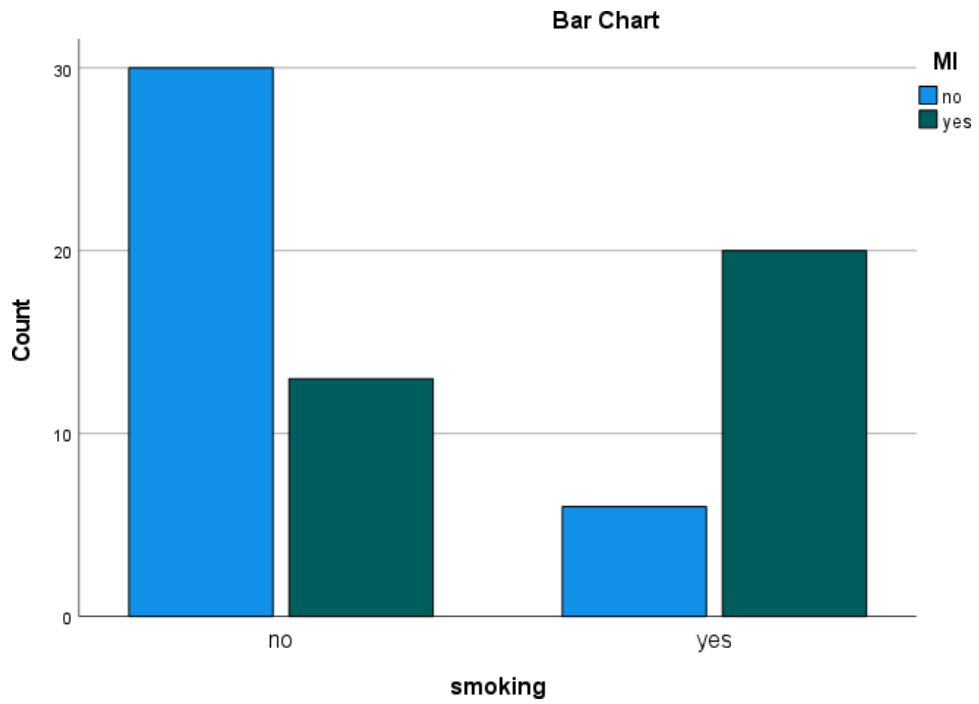

Figure 4.4: Myocardial infraction and smoking status.

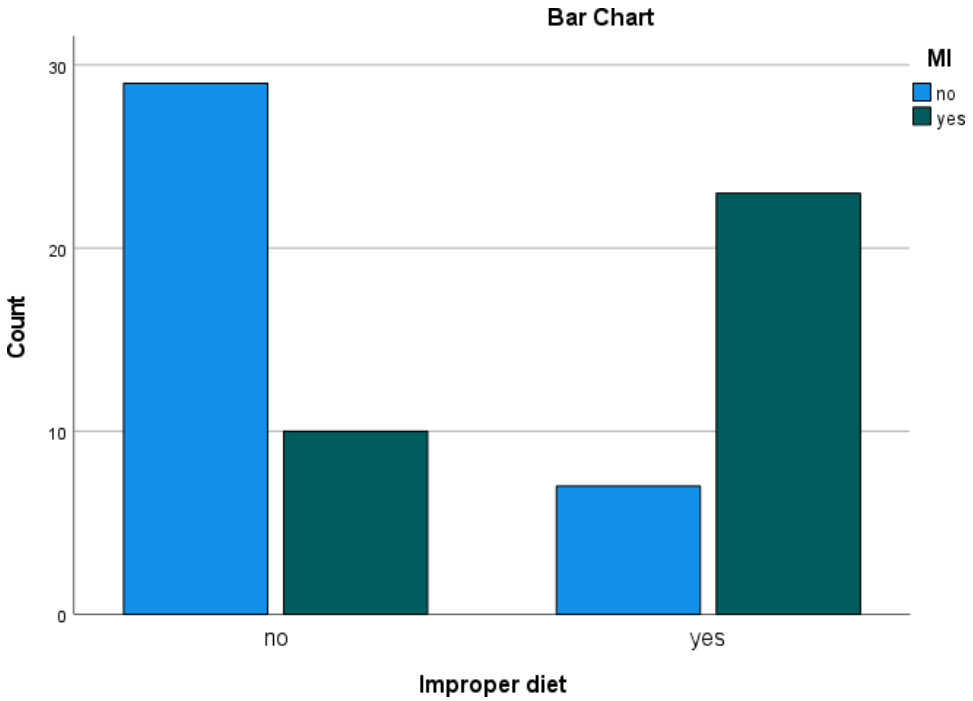

Figure 4.5: Myocardial infraction and improper diet.

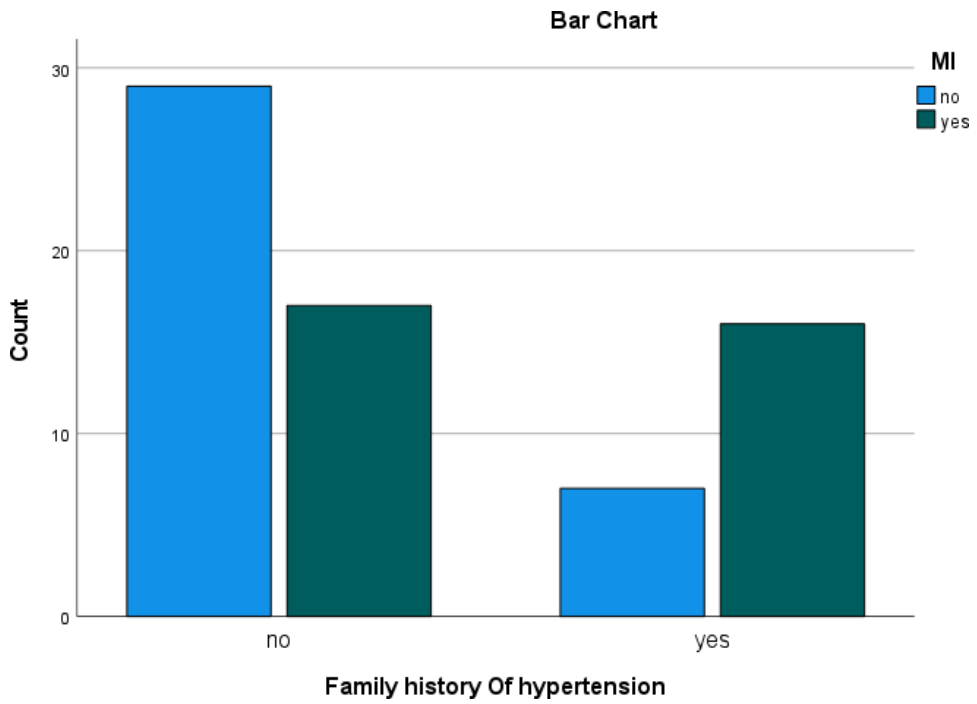

Figure 4.6: Myocardial infraction and family history of hypertension.

The age of participants with MI was significantly higher (mean 67 years, SD ± 11) compared to those without MI (mean 54 years, SD ± 11), with P < 0.01. Similarly, the duration of hypertension was longer in MI patients (mean 12 years, SD ± 5) than in those without MI (mean 7 years, SD ± 4), with a significance of P < 0.01. However, BMI did not show a significant difference between the two groups (P > 0.05) (Table 3).

Table (3): Age, duration of hypertension, Body mass index and myocardial infraction

Variable	Myocardial infraction		P-value
	No	Yes	
	Mean ± SD	Mean ± SD	
Age in years	54 ± 11	67 ± 11	**<0.01****
Duration in years	7 ± 4	12 ± 5	**<0.01****
BMI	24.1 ± 4.1	24.6 ± 3.5	>0.05 N.S.

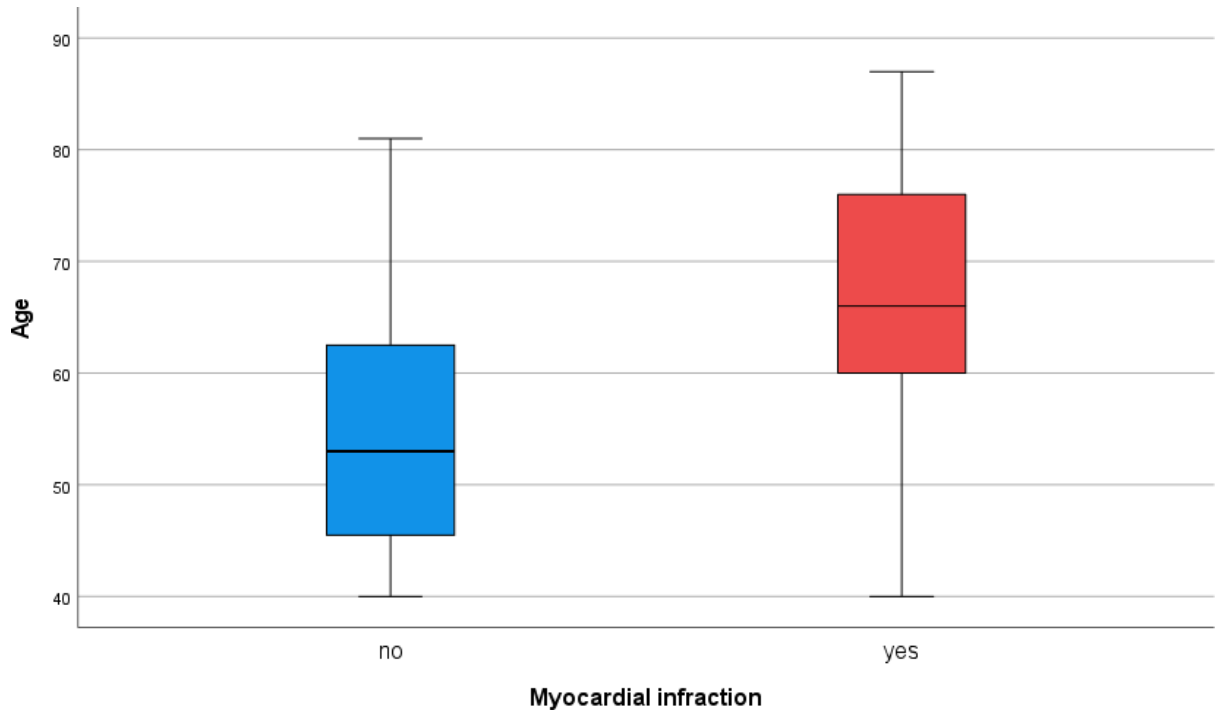

Figure 4.7: Myocardial infraction and age.

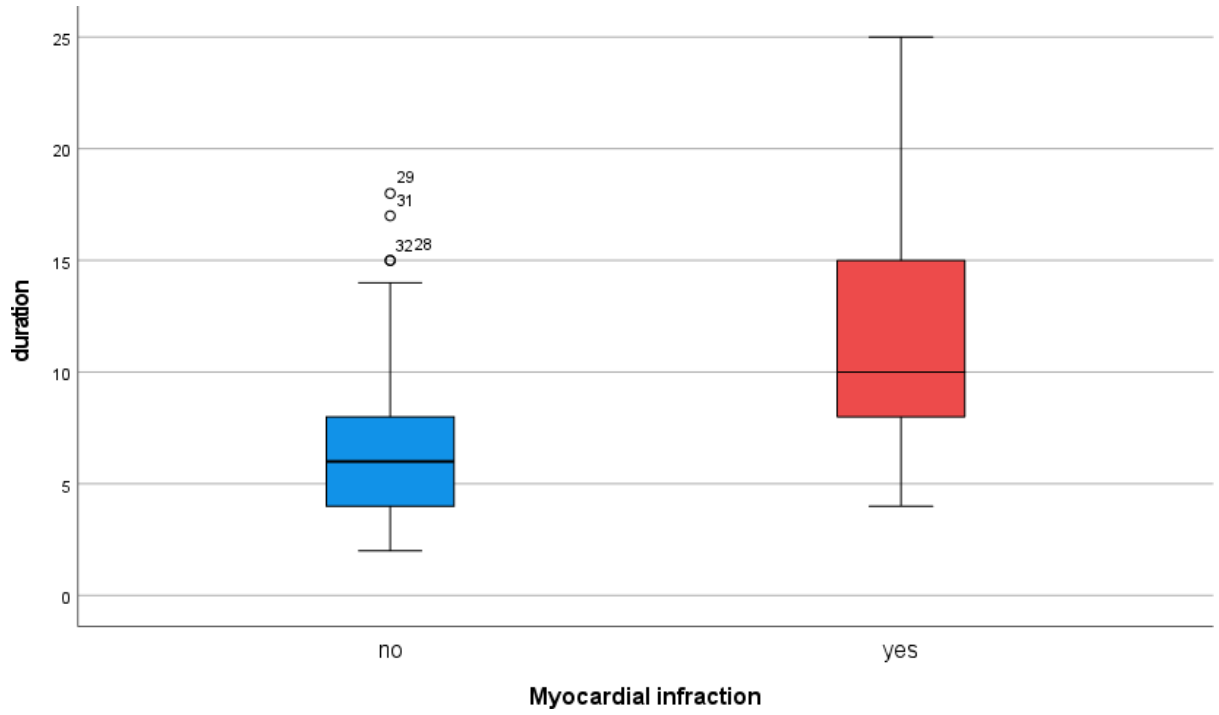

Figure 4.8: Myocardial infraction and duration of hypertension.

Discussion

Our study at Baquba Teaching Hospital identified significant associations between myocardial infarction (MI) in hypertensive patients and factors such as improper diet, smoking, uncontrolled hypertension, and family history of hypertension. These findings align with and add to the existing literature on cardiovascular risks in hypertensive patients.

Wang's longitudinal study highlighted that younger onset of hypertension is associated with higher risks for cardiovascular diseases (CVD) and mortality. This aligns with our findings, where age and duration of hypertension significantly correlated with MI incidence. Wang's results suggest that early-onset hypertension poses a greater risk, underlining the importance of early intervention and management, a concept supported by our study's emphasis on controlled hypertension (15). Valerio's study on the influence of family history on cardiovascular diseases among different ethnic groups found a strong correlation between positive family history and the prevalence of nonstroke cardiovascular disease and stroke. This is consistent with our findings, where a family history of hypertension significantly increased the risk of MI. Our study and Valerio's both underscore the importance of family history as a critical factor in cardiovascular risk assessment (16).

Konstantinou's analysis of the role of hypertension in acute coronary syndromes (ACS) and MI underscores hypertension as a prevalent factor among MI patients. This complements our findings, where hypertension management appeared as a significant factor. Both studies emphasize the need for effective blood pressure control as a part of secondary prevention in hypertensive patients to mitigate the risk of MI (17). Fagard's research highlights smoking as a risk factor for coronary heart disease in hypertensive and diabetic patients. This finding is mirrored in our study, where smoking was significantly associated with an increased risk of MI.

Both studies reinforce the detrimental impact of smoking on cardiovascular health, especially in hypertensive patients (18). In addition, Gao's study on the long-term impact of smoking suggests a significant association with hypertension and MI. This aligns with our findings on the role of smoking as a risk factor for MI. Gao's emphasis on the life-course perspective of smoking's impact further supports our observation of the cumulative effect of smoking on hypertensive patients (19).

Iqbal's research on dietary patterns and AMI risk indicates that prudent dietary habits are protective against AMI. Our study's finding on the significant association of improper diet with MI complements this, highlighting the critical role of diet in cardiovascular health. Both studies underscore the need for dietary management as a part of comprehensive cardiovascular risk reduction strategies (20).

Our study adds to the growing body of evidence that effective management of hypertension, lifestyle modifications like diet control and smoking cessation, and awareness of family history are pivotal in reducing the risk of MI in hypertensive patients. It underscores the multi-factorial nature of cardiovascular risk and the need for a holistic approach in managing hypertensive patients, taking into account individual, familial, and lifestyle factors.

While our study provides valuable insights, it is limited by its cross-sectional nature and the small sample size. Future research should focus on longitudinal designs to establish causality and explore the mechanisms underlying these associations. Also, expanding the study to diverse populations would enhance the generalizability of the findings.

Conclusion and Recommendations

Conclusion

The cross-sectional study conducted at Baquba Teaching Hospital provided valuable insights into the risk factors associated with myocardial infarction (MI) in hypertensive patients. Nearly half of the hypertensive patients had a history of MI, underscoring the significant burden of cardiovascular complications in this population. The study found a higher prevalence of MI in older patients and those with a longer duration of hypertension. This highlights the cumulative effect of hypertension on cardiovascular health over time. Significant associations were found between MI and factors such as smoking and an improper diet. These modifiable risk factors present opportunities for intervention. Patients with controlled hypertension had a lower incidence of MI, emphasizing the importance of effective management of blood pressure. A family history of hypertension was significantly associated with the occurrence of MI, indicating the role of genetic predisposition in cardiovascular risk.

Recommendations

Based on the findings, the following recommendations are proposed:

1. **Targeted Screening and Early Intervention**: Enhanced screening for MI should be prioritized in older hypertensive patients and those with a long history of hypertension.
2. **Lifestyle Modifications**: Public health initiatives should focus on educating hypertensive patients about the importance of a healthy diet, regular exercise, and smoking cessation.
3. **Effective Management of Hypertension**: Healthcare providers should emphasize the control of hypertension through appropriate medication, regular monitoring, and patient education.

4. **Family History Considerations**: Patients with a family history of hypertension or heart attack should be counseled about their increased risk and encouraged to undergo regular cardiovascular screening.
5. **Further Research**: Additional studies with a larger sample size and diverse populations are needed to validate these findings and explore other potential risk factors.